

# Is Sodium Carbonate in Snuff a Causative Factor for Oral Mucosal Lesions: A Cross-sectional Analysis

Iqbal Singh<sup>1</sup>, Amarpreet Singh<sup>2</sup>, Robindera Kour<sup>3</sup>, Abhiroop Singh<sup>4</sup>, Romesh Singh<sup>5</sup>, Ashish Bali<sup>6</sup>

<sup>1</sup>Department of Public Health Dentistry, Indira Gandhi Dental College and Hospital, Jammu, <sup>2</sup>Department of Public Health Dentistry, Himachal Dental College and Hospital, Sunder-Nagar, Himachal Pradesh, <sup>3</sup>Department of General Surgery, Government Hospital Sarwal, Jammu, <sup>4</sup>Department of Oral and Maxillofacial Surgery, Dav Dental College, Yamuna-Nagar, Haryana, <sup>5</sup>Department of Periodontology, Indira Gandhi Dental College, Jammu, <sup>6</sup>Department of Periodontology, Himachal Dental College and Hospital, Sunder-Nagar, Himachal Pradesh, India

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ABSTRACT

**Aims and Objectives:** Nicotine absorption through the mucous membrane is directly proportional to pH, so the snuff is buffered to pH of 8–9 by adding sodium carbonate. The objective of the present study is to assess the impact of various forms of sodium carbonate in snuff on mucosal conditions.

**Materials and Methods:** The present cross-sectional study was conducted on 284 participants. Snuff users adding sodium carbonate were further splitted into two groups, that is, one group using sodium carbonate in premixed form, that is, (already mixed within pouches) and other group adding sodium carbonate separately (freshly mixed). The parametric one-way (ANOVA) of variance, stepwise regression analysis, and multiple logistic regression analysis have been done to narrate the relationship between variables of different forms of sodium carbonate in snuff and different oral conditions.

**Results:** The statistics of our study reveals highly significant relationship between snuff users using sodium carbonate in freshly mixed (0.001\*\*) form than that of premixed form ( $P = 0.030^*$ ).

**Conclusion:** The present study narrates that there seems to be liaison between the use of sodium carbonate in snuff and oral mucosal lesions.

**KEYWORDS:** Oral mucosal lesions, smokeless tobacco, snuff, sodium carbonate

## INTRODUCTION

The prevalence of tobacco in smokeless form is globally spreaded from Sudan and India to Scandinavia and USA.<sup>[1]</sup> Among all the forms of smokeless tobacco product, the snuff is widely used and it is more prevailing among the youth.

The use of snuff is based on mechanism that the product directly releases nicotine when it is placed in the vestibule between gum and cheek.<sup>[2]</sup> The intake of snuff is very popular in North America, Scandinavia, and in some parts of Asia (i.e., Bangladesh, Bhutan, and India) also in some parts of Africa (e.g. Algeria, Sudan, and Nigeria). The snuff is manifested in two ways; the loose form and another form in which it is packed in small filter sachets or pouches. The pouch form has gained a lot of popularity in recent times. These pouches are inserted in the vestibule for approximately 30 min

resulting in nicotine absorption and then disposed.<sup>[3]</sup> The use of snuff results in dependency due to the release of high dosage of nicotine.<sup>[4]</sup> The composition of snuff includes water, tobacco, moist preservatives, taste enhancers (salt), acidifiers, and aromas. The tobacco itself is composed of 2500 chemical components, in which nicotine is most common, the other components are sodium carbonate, sodium chloride, tobacco-specific nitrosamines, and polycyclic aromatic hydrocarbons.<sup>[5]</sup> The nicotine absorption takes place through the mucous membrane by passive diffusion.<sup>[6]</sup> A very important aspect which is playing a censorious role for passive diffusion of plenty of drug aggregates is the volume of

**Address for correspondence:** Dr. Iqbal Singh, 204/3 Ext Trikuta Nagar, Opposite Jammu and Kashmir Bank, Jammu, Jammu and Kashmir, India. E-mail: gogjibagh24@gmail.com

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drug present in unionized form. The unionized drugs undergo unflappable dissipation more promptly than their analogous ionized forms because there is more solubility of uncharged molecules in lipophilic cellular membranes. The magnitude of drug in unionized form is resolved by dissolution factor of drug and the pH of medium of drug, resulting in pH dependency of consumption of several drugs through the oral mucosa and forms the footing for poignant drug delivery through carting of the oral pH.<sup>[7]</sup>

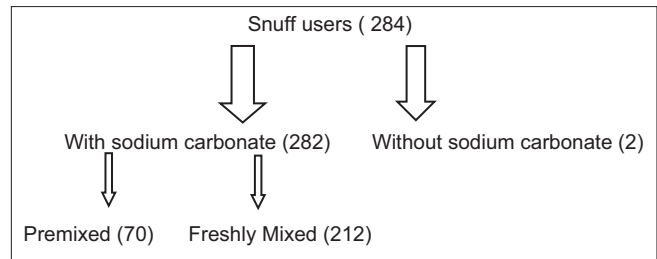
The nicotine absorption through the mucous membrane is directly proportional to pH, so the snuff is buffered to pH of 8–9 by adding sodium carbonate.<sup>[7]</sup> The nicotine dosage in snuff is dependant on the pH level, amount of nicotine in the product, and size of tobacco cutting.<sup>[2]</sup> There are various researchers who have quoted the consociation of smokeless tobacco/moist snuff product pH and nicotine absorption; however, we are aware of no studies, in which the resulting pH for mixtures of commercial moist snuff and saliva is mentioned.<sup>[7]</sup> The pH is directly proportional and plays a very important role in nicotine absorption.<sup>[8]</sup> Tobacco smoking has a major impact on many tissues and organs of the body, including the periodontal tissues. Hence, the objectivity of the present study is to assess the impact of various forms of sodium carbonate present in snuff on oral condition among snuff users in Jammu, India.

## MATERIALS AND METHODS

The present cross-sectional study has been conducted in Jammu region to access the impact of different forms of sodium carbonate present in snuff on the oral health status of snuff users.

### SAMPLING

The current study has been conducted among workers at various construction sites in Jammu region. The participants were selected on the basis of the prevalence of snuff use which was high among the construction workers. A total of 284 snuff using workers participated in the study. The participants were selected through stratified random sampling technique. All the study participants were informed before the start of the study and the informed consent was obtained. The study has been performed by taking permission from the principal of Indira Gandhi Dental College, Jammu, with letter number IGGDC/Estt/GD/235. It took the duration of 3 months for conducting this study, that is, from December 2017 to February 2018. The participants who were using snuff regularly from 5 years and whose age was ranging between 25 years and 60 years were included for both genders. Snuff users adding sodium carbonate were further splitted into two groups, that is,



**Figure 1:** Design of the study

one group using sodium carbonate in premixed form, that is, already mixed within pouches and other group adding sodium carbonate separately (freshly mixed).

The present study was carried out in the following pattern as shown in Figure 1.

### METHODS OF DATA COLLECTION

The examination was done on an ordinary chair with backrest under natural light. A predesigned structured questionnaire is made to record information regarding general data, type of moist snuff with and without sodium carbonate, duration, and frequency of using moist snuff. The Axell's index was used to find the degree of severity of oral lesions. Before the start of the study, the two examiners were trained to levels of accuracy and reproducibility for the various clinical parameters to be used.

The armamentarium used in the present study was Community Periodontal Index probe, mouth mirror and explorer, and tweezers, which were sterilized properly. The parametric one-way (ANOVA) of variance, stepwise regression analysis, and multiple logistic regression analysis has been done to narrate the relationship between variables of different forms of sodium carbonate in snuff and different oral conditions.

### RESULTS

Table 1 showed number and percentage of snuff users with and without sodium carbonate in both forms, that is, freshly mixed and premixed.

Table 2 shows the correlation of oral snuff containing sodium carbonate in freshly mixed form using multiple logistic regression analysis, and it was found to be having significant relationship with oral mucosal lesions, snuff lesions, and dental erosion.

Table 3 shows the correlation of oral snuff containing sodium carbonate in premixed form using multiple logistic regression analysis, and it was found to be having significant relationship with oral mucosal lesions and snuff lesions.

**Table 1: Distribution of snuff users according to the addition of sodium carbonate**

Adverse habits	n (%)
Number of snuff users	284
Number of snuff users without sodium carbonate (n)	2 (0.5)
Number of moist snuff users with sodium carbonate (n)	282 (99.4)
Premixed	70 (18)
Freshly mixed	212 (81.6)

n=Number of patients in a particular category

**Table 2: Multiple logistic regression analysis showing sodium carbonate freshly mixed in relation with oral conditions**

Dental lesions	Freshly mixed	R	P	Significance
Oral mucosal lesions	212	0.0792	0.001**	Significant
Snuff lesions	212	0.0767	0.051*	Significant
Gingival recession	212	0.681	0.653	Nonsignificant
Dental attrition	212	0.528	0.391	Nonsignificant
Dental erosion	212	0.016	0.048*	Significant
Dental abrasion	212	0.134	0.750	Nonsignificant
Burning sensation	212	0.174	0.571	Nonsignificant

$P \leq 0.05$  - significant, CI=95%. CI=Confidence interval, \*\*Highly significant, \*Significant

**Table 3: Multiple logistic regression analysis showing sodium carbonate premixed in relation with oral conditions**

Dental lesions	Premixed	R	P	Significance
Oral mucosal lesions	70	0.094	0.030*	Significant
Snuff lesions	70	0.055	0.044*	Significant
Gingival recession	70	0.391	0.458	Nonsignificant
Dental attrition	70	0.210	0.369	Nonsignificant
Dental erosion	70	0.010	0.512	Nonsignificant
Dental abrasion	70	0.451	0.790	Nonsignificant
Burning sensation	70	0.540	0.505	Nonsignificant

$P \leq 0.05$  - significant, CI=95%. CI=Confidence interval, \*Significant

## DISCUSSION

The present cross-sectional study has been conducted on the basis of high prevalence of oral mucosal lesions among snuff users with the addition of sodium carbonate. The present study included a sample of 284 workers who were chronic snuff users from various construction sites and slums in Jammu region. The snuff users were further categorized in two groups, that is, one group mixing sodium carbonate in fresh form and other group, in which sodium carbonate was available in premix form in pouches.

The main objective of the study was to narrate the association between different forms of sodium carbonate, that is, freshly mixed and premixed form used in snuff and oral mucosal lesions among the snuff users in Jammu region.

The present study indicates the high prevalence of oral mucosal lesions among snuff users with the addition of sodium carbonate both in freshly mixed as well as in premixed form.

The primary outcome of the present study reveals highly significant relationship between snuff users using sodium carbonate (0.001\*\*) in freshly mixed form than that of premixed (0.030\*) form. Similar study has been done by Singh *et al.* in Jodhpur, India, showing higher prevalence of oral mucosal lesions among snuff users.<sup>[9]</sup> It is due to reason that there is a rise in pH and hence more absorption of nicotine due to addition of sodium carbonate in freshly mixed form than that of premixed form packed in pouches. Gerd Kallischnigg in his systematic review has shown that there are about 33 epidemiological studies depicting consociation between snuff and prevalence of oral mucosal lesions.<sup>[10]</sup> The degree of oral lesions is positively correlated with age, frequency, and duration of snuff use in studies conducted by Hirsch *et al.*, 1982;<sup>[11]</sup> Andersson *et al.*, 1991;<sup>[12]</sup> and Amadori *et al.*, 2017.<sup>[13]</sup> Similar results are reported by a study conducted by Anzil *et al.*<sup>[14]</sup> on fisherfolk community showing high prevalence of tobacco use and oral mucosal lesions.<sup>[14]</sup> Moist snuff use may be associated with adverse oral lesions. It has been seen in our study that use of moist snuff is significantly responsible for causing mucosal changes. Numerous other studies have observed that snus use is associated with a characteristic reaction in the oral mucosa, for example, Axéll, 1976;<sup>[15]</sup> Andersson *et al.*, 1989;<sup>[16]</sup> Andersson *et al.*, 1991;<sup>[14]</sup> and Rolandsson *et al.*, 2006.<sup>[17]</sup>

This type of lesion has been referred to by various names, including snuff dipper's lesion, snuff-induced leukoplakia, or snus-induced lesions. The lesion generally appears at the location in the mouth where the snus is held. The prevalence of this condition varies widely and appears to be related to characteristics of the user (such as age, salivary pH, and patterns of tobacco use) and characteristics of the product (nicotine content, loose versus. portion bag, etc.). In addition, the degree of lesions seems to increase with increasing pH as well as increasing nicotine concentration according to Andersson *et al.*<sup>[12]</sup> The snuff leads to rise in pH to about 8–9, thereby facilitating nicotine absorption by the oral mucosa causing local reactions in gingival tissues on exposing to snuff leading to mucosal changes and oral lesions.<sup>[18]</sup> A study conducted by Mavropoulos has shown that there is a rise in blood flow in the gingiva and oral mucosa after nicotine absorption.<sup>[19]</sup> Alpar *et al.* 1998 have demonstrated in his study that there is a decrease in oral fibroblasts on exposure to nicotine.<sup>[20]</sup>

The secondary outcomes of the study have depicted that dental erosions were found to be significantly higher

in individuals using sodium carbonate in freshly mixed form of snuff.

The main limitation of the present study was failure to adjust for important potential confounding factors which can be, particularly regarding alternative tobacco consumption, either smoked or smokeless.

## CONCLUSION

The conclusions that can be drawn from results of the present study depicts a positive correlation between sodium carbonate in snuff and oral mucosal lesions. The results of the present research give an standardized approaches permitting the study to be replicated in different areas or over time with the production of comparable findings. It is possible to control for the extraneous effects of snuff that might result in misleading interpretations of causality. The study findings can be generalized to the population involved in snuff use.

The public policy implications of snuff use need to be considerably systematized with the use of more consistent definitions of tobacco consumption and study methodologies. More rigorous comparable prevalence studies using standard “Tobacco Questions for Surveys” over time are needed to establish the trends in prevalence and evaluate the effect of different public policies pursued to control tobacco use. Second, the future studies should investigate the prevalence rates of different tobacco products (both smoking and chewing tobacco) separately, as the economic and health effects of different products vary considerably.

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## CONFLICTS OF INTEREST

There are no conflicts of interest.

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